AERO DESIGNS PULSAR XP

STAR QUALITY

Viewing a Very Light Aircraft category contender that mates light speed with a heavenly body.

BY MARC E. COOK

It's tempting, what with the cooperative attitude of the Federal Aviation Administration and the simplified very light aircraft (VLA) certification rules, to do a bit of stargazing, to imagine which exciting homebuilt models might become production aircraft. One might expect the rules to spawn a few new designs but also to kick a few existing kits into showrooms. • For now, though, the regulations spotlight small airplanes, those 1,654 pounds maximum gross weight and under. Hence the "L" in VLA. This limitation, along with the ones regarding no night/IFR operation and a maximum of two seats, begs the question: How good would a production VLA airplane be in a day-to-day role, for sightseeing or for training? • To get a fix on where such a light airplane might fit into the existing GA constellation, we focused our editorial telescope on Aero Designs, in San Antonio. The firm is now busy producing a kit airplane that would fit both the letter

PHOTOGRAPHY BY MIKE FIZER

and intent of the VLA rules. At 1,060 pounds maximum gross weight, the Pulsar, a low-wing composite two-seater, would seem an ideal candidate. And we won't make you wait for the answer to the question posed above: Based on our time with the Pulsar XP, it would, despite the implications presented by diminutive proportions and light weight, perform recreational or educational roles with aplomb. Don't be scared off by the numbers: Though no heavyweight, the Pulsar flies like a much more substantial model. It is neither a kite nor a toy.

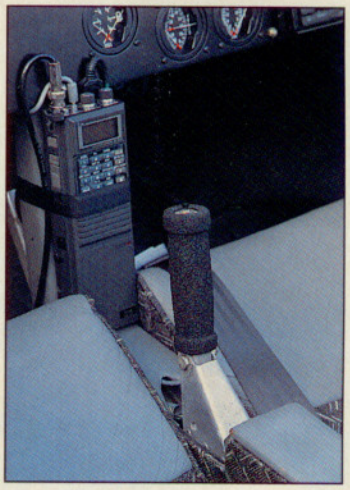
Company founder Mark Brown has always believed goodness comes from low weight. An engineer by trade, he contributed his talents to Fairchild, Aero Commander, and Ling Temco Vought (LTV), where he helped perform stress analysis on a prototype carbon-fiber wing for the A-7 attack jet. Tired of pushing pencils and shuffling paper, he turned toward more sporting aircraft, and his first design would by 1983 become the Star-Lite, a composite single-seater.

The Star-Lite's combination of simple structure, light weight—maximum gross was 500 pounds—and aerodynamic cleanliness gave it a 104-knot cruise on little power. Propulsion in later versions came from a Rotax 447 of 40 horsepower. It was a star-crossed venture, though. Two builders believed their own engineering better than the factory's and departed from the plans. A pair of airframe failures and fatalities resulted. After 120 kits were sold—the design's success surely hampered by the bad reputation that followed the accidents—Brown set out on a new project, a two-seat follow-on to the Star-Lite.

That's the Pulsar. When the design debuted in 1985, it was carried along by another Rotax two-stroke, this time the 66-hp 582. That model still is available and makes up half the number of Pulsar kits ordered today. But more interesting, and certainly more aligned with production notions, is the Rotax 912-powered XP. Both models share major airframe dimensions, including the 25-foot wingspan, and features, like push-rod-operated ailerons and elevator, removable wings and horizontal tail, and plain flaps. The 912 pictured here belongs to Rick Meyer, an Aero Designs employee, who had his first-ever light airplane ride in a Pulsar and liked it so much that he

began building one. Then he found he liked the company so much, he joined it. His is the first 912-powered airplane to fly, and frankly, the photos don't do his craftsmanship justice.

Before we move on, it might be time to revisit that old saw about how airplane design is held prisoner by engine technology. In the case of small, light sport airplanes, the powerplant of choice has been one of many Rotax two-stroke engines. These models range from less than 30 hp to nearly 70 hp and have found homes in aircraft, snowmobiles, motorcycles, and a variety of other applications.



But there's a pilot contingent that feels any engine that sounds more like a lawn mower than a Pratt & Whitney no more belongs under the cowl than does a Briggs and Stratton. So in the late 1980s, Rotax responded with the 912, a horizontally opposed four-cylinder four-stroke, just like your old O-320. Displacing a mere 74 cubic inches, the engine makes 80 hp at 5,600 engine rpm; the integral reduction drive turns the propeller 2,545 rpm at redline.

While the 912 breaks no truly new ground, it surely is the result of solid, rational engineering. Its dimensions are smaller than the various Volkswagen derivatives and look-alikes—which, to be fair, are larger displacement engines, by as much as a factor of two. With liquid-cooled heads and diminutive fins on the cylinder sleeves, cowling design and baffling are not major factors, and hydraulic cam followers reduce maintenance requirements.

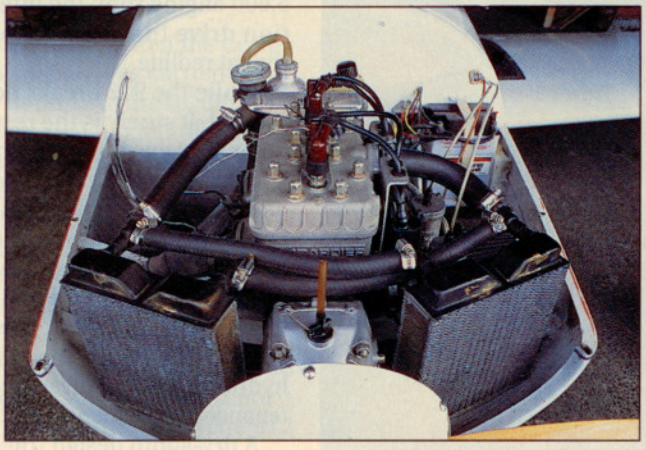
A dry-sump design (the bulk of the oil is carried in an external tank), the 912 simplifies packaging, and its cylinder heads take aviation-style shielded spark plugs, two to a cylinder. These plugs are fired from a dual-coil distributor-less electronic ignition. Each of two Bing constant-velocity carburetors feed a pair of cylinders through short intake manifolds.

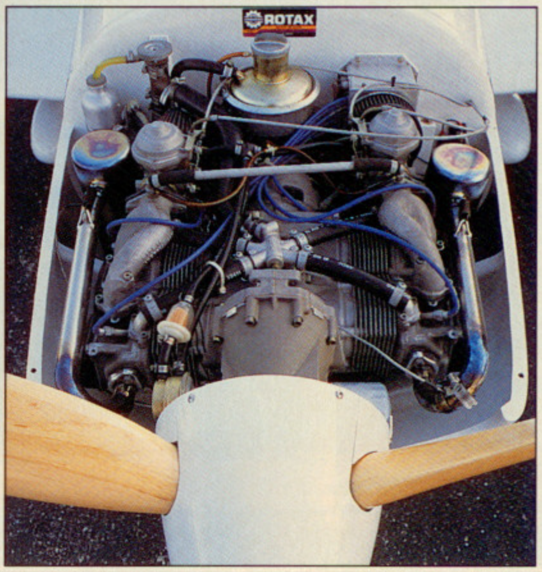
Out in the real world, the 912 shines as brightly as it does on the specifications page. It's amazingly smooth—especially so behind a wood propeller—and quite fuel efficient. Aero Designs claims to average 3.5 gallons per hour from the 912 at about 75-percent power—which is an astonishing specific fuel consumption of 0.35 pph/hp. Even the most fuel-stingy aircraft engines work pretty hard to keep it below about 0.4 pph/hp. One explanation might be that, because the carburetors breathe air from the back of the cowling—in effect, with carb heat always on—the engine isn't making the full-rated 75-percent power at the specified rpm and therefore isn't burning as much fuel.

Flying both models of the Pulsar back-to-back helps prove that an engine swap can totally alter the character of an airframe. Although essentially identical—the differences are limited to placement of the fuel tanks and minor structure alterations—the 582-powered Pulsar and the XP are two vastly different airplanes from the seat-of-the-pants perspective.

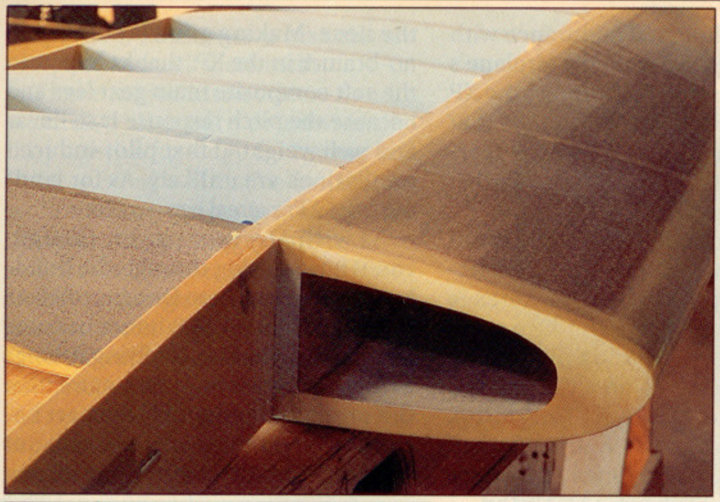
In the 582, you feel attached to an agile airplane, with the rasping of the two-stroke up front and light control response. It's suited for a trip down to the local lake or out to the beach airstrip. Best enjoyed in a T-shirt and shorts, with a picnic lunch in the baggage bay, the 582 Pulsar is something of an aerial motorcycle: quick, sprightly, but none too serious. Which is fine, as it wasn't intended to be anything else.

Hop into the 912-propelled XP, and you move into a more substantial air-





Pulsar models can be propelled by a two-stroke Rotax 582 (above) or the heavier but more powerful four-cycle Rotax 912.



Wing construction mates composite main spar to foam ribs and wood skins. Fuselage halves are cured in these molds under heat and pressure.

plane. The four-stroke idles with a whir and goes about its business quietly. There's enough torque that the engine never feels as though it wants to back down under load—unlike the 582, which has a substantially narrower useful powerband. Also, because the propeller turns the "normal" way, you don't have to second-guess your feet—you use right rudder on takeoff and climb, just like your basic Piper.

Only most Pipers don't still have heel brakes; both Pulsar models do. On Meyer's XP, the standard-issue mechanical band brakes have been supplanted with hydraulic discs, but you still have to get used to using your heels to do the work normally accorded to toes. And with a free-castering nosewheel, the Pulsar makes you work the brakes for taxiing and at the start of the takeoff roll. Fortunately, there's enough friction in the steering that you don't end up scribing serpentine motions on the taxiway.

For departure, advance the throttle smoothly and use minimal braking for the shortest ground roll. The rudder becomes effective at relatively low airspeed—in fact, for touch and goes, you need not worry about the brakes at all, as there's sufficient rudder authority to keep the Pulsar's slender nose on the centerline.

At about 100 pounds under maximum gross, the XP climbs out at 1,000 feet per minute at an indicated 69 knots—actual best-rate speed is 60 knots. This ascent tapers to about 700 fpm at 7,000 feet density altitude. According to the company, the three-blade, ground-adjustable GSC wood prop helps some in climb but saps 2 or 3 knots at cruise.

Still, the XP turns in good cruise numbers given the horsepower. At 5,200 engine rpm (a predicted 75 percent but remember the caveat about carb-air temperature mentioned earlier), the XP indicates 110 knots at a density altitude of 7,400 feet, for a true of 123 knots. These numbers align with the company's claim of 140 mph/122 knots at 5,200 rpm. Count on about 4.6 hours of endurance with a one-hour reserve from the airplane's 19.5-gallon usable fuel supply; the XP uses two 9.75-gallon wing tanks that help move the center of gravity rearward, while the 582 has a single 16-gallon header tank.

Such speed from 80 hp is the result of good aerodynamics, a small airframe, and light weight. Wing area is 80 square feet, giving the XP a wing loading of 13.25 pounds per square foot, midway between a Cessna 152 and 172. Power loading is 13.25 lb/hp, better than most simple airplanes and close to an F33A Bonanza and better than a 160-hp Skyhawk's 14.3 lb/hp.

Though the Pulsar is no Bonanza with regard to interior room, it compares well with other two-seaters. The cabin is wider than a Cessna 150's by a good margin, and even a bit better than a Tomahawk or Skipper. And it's comfortable for two people and their traveling wares. Seats inclined 35 degrees and ample legroom should help take the pinch out of long stints under the broad canopy—which, by the way, offers superlative visibility and is simple to operate on its three-point rollers. A center control stick saves interior room and a number of bits and pieces, too. The stubby lever can be comfortably manipulated from either seat, and a full-length armrest helps steady one's arm so that overcontrolling in turbulence is less likely.

It's the responses you get from wiggling that stick that most surprise someone new to the Pulsar. As mentioned earlier, the Pulsar flies like a heavier airplane, despite its size and weight. One might expect an airplane so light to be darty and unstable, but that's not true. In fact, the Pulsar is far more stable (the 912 version especially) than much larger homebuilts. It's about on par with the Bonanza in terms of pitch response and roll rate; although without the benefit of a large airplane's inertial damping, the XP is not as unflappable in turbulence. All told, the Aero Designs crew deserves high praise for making a low-mass airplane act much larger and heavier than it is.

These characteristics carry through in the traffic pattern, too. Keep the airplane trimmed—via a lever in front of the instrument-panel centerpost—and it will fly stabilized approaches all day long. The plain flaps help slow the airplane to a final approach speed of 60 knots and afford a bit better view over the nose. Making good landings is a no-brainer in the XP, thanks in part to the soft composite main gear legs and because the pitch response is so linear and well weighted that pilot-induced oscillations are unlikely. As for landings, the XP is a real ego-sweller.

As with any homebuilt, though, you'll have to slog through the building process first. Aero Designs predicts the XP will take 1,000 hours to complete. So far, the only XP flying belongs to Meyer, and he took a bit more than the predicted time, in large part because the company was working out some on-the-job engineering during the process. Construction manuals are complete and well illustrated.

Three major kit sections can be purchased all at once or individually; they are the fuselage including tail surfaces, wing, and engine-installation sections. Basic prices for the kits, including crating charges, break down as follows: fuselage, $7,440; wing, $6,290; and engine, instruments, and installation, $10,970. If you want to receive the entire kit all at once, the total cost is $24,250, a savings of $550. The 582 version, because the engine is less expensive and the kit itself is somewhat simpler, runs $18,850 total and $600 less if you take complete delivery. You must add any instruments beyond those necessary for basic VFR, plus interior, paint, and avionics. All told, $30,000 should get your XP completed with minimal avionics.

When you open the crate, you will find all the major components and all the raw materials, including resin and glass. Basic construction of the Pulsar is from oven-cured pre-preg fiberglass, bonded with Epolite 2315 epoxy. (In other words, the fuselage and tail are preformed at the factory from foam-core fiberglass and cured under temperature and pressure.) The wings detach at the roots, and the composite spar mates to foam ribs and a thin plywood wing skin—according to Aero Designs, the wood is cheaper, easier to work with, and lighter than composite in this application.

Is the Pulsar a good kit-built airplane? From all outward appearances, yes, especially when you take into account the clever ways in which the design eschews complexity and expensive components. Would it make a good production airplane? From the consumer's standpoint, absolutely. There's enough utility in the 912-powered XP to make it a fine personal transport, and the handling qualities lend themselves readily to training. In fact, Meyer has taken all his flight instruction in the Pulsar, and his instructor says that he wishes there were more airplanes like the XP for teaching the fine art of flying.

Should all the stars align and the VLA rules make production of the Pulsar XP feasible and profitable for Aero Designs, we are told that it should happen. If so, the XP would be a welcome member of the fun club and a great vehicle from which to view the sun, the sea, and, yes, the stars. □

Aero Designs Pulsar XP
Kit price: $24,700

Specifications	
Powerplant	Rotax 912, four-stroke, four-cylinder, 80 hp at 5,600 rpm
Propeller	GSC three-blade wood, 60-inch diameter
Length	19.5 ft
Height	6.3 ft
Wingspan	25 ft
Wing area	80 sq ft
Wing loading	13.25 lb/sq ft
Power loading	13.25 lb/hp
Seats	2
Estimated empty weight	510 lb
Empty weight, as tested	530 lb
Max takeoff weight	1,060 lb
Max landing weight	1,060 lb
Fuel capacity	19.5 gal
Oil capacity	3 qt (2 qt min)
Performance	
Takeoff distance, ground roll	800 ft
Takeoff distance over 50-ft obstacle	1,400 ft
Max demonstrated crosswind component	15 kt
Rate of climb, sea level	1,200 fpm
Max level speed, sea level	143 kt
Cruise speed (fuel consumption) @ 75 percent power 7,500 ft	122 kt (3.5 gph/21 pph)
Landing distance over 50-ft obstacle	1,600 ft
Landing distance, ground roll	800 ft
Limiting and Recommended Airspeeds	
V_A (design maneuvering)	90 KIAS
V_{NO} (max structural cruising)	130 KIAS
V_{S1} (stall, clean)	43 KIAS
V_{SO} (stall, landing configuration)	40 KIAS

For more information, contact: Aero Designs, Incorporated, 11910 Radium Street, San Antonio, Texas 78216; 512/308-9332.

All specifications are based on manufacturer's calculations. All performance figures are based on standard day, standard atmosphere, sea level, gross weight conditions unless otherwise noted.